

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| In re Application of: |) | |
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| Katsumi SHIBAYAMA et al. |) | Confirmation No.: 2756 |
| |) | |
| Application No.: 10/715,118 |) | Group Art Unit: 2814 |
| |) | |
| Filed: November 18, 2003 |) | Examiner: Shrinivas H. Rao |
| |) | |
| For: BACK ILLUMINATED |) | |
| PHOTODIODE ARRAY, |) | |
| MANUFACTURING METHOD AND) |) | |
| SEMICONDUCTOR DEVICE |) | |
| THEREOF |) | |

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Window, Mail Stop AF
Alexandria, VA 22314

Sir:

REQUEST FOR PRE-APPEAL BRIEF CONFERENCE

Applicants respectfully request a pre-appeal brief conference for the reasons set forth below. Applicants respectfully submit that clear errors exist in the 35 U.S.C. § 103(a) rejection of claims 1, 3-15 and 27 based on Mattson et al. (U.S. Patent No. 6,426,991) and Chappo et al. (U.S. Patent No. 6,510,195) in view of Bauer et al. (U.S. Patent Application Publication No. 2002/0011640). Applicants also respectfully submit that clear errors exist in the 35 U.S.C. § 103(a) rejection of claim 16 based on Mattson et al., Chappo et al. and Bauer et al. in further view of Yamanaka et al. (U.S. Patent No. 6,372,558). Applicants further respectfully submit that clear errors exist in the 35 U.S.C. § 102(e) rejection of claim 26 based on Chappo et al., and in the 35 U.S.C. § 102(e) rejection of claim 28 based on Chappo et al. in view of Bauer et al. It is understood that since the rejection of claim 28 is based on a combination of references, the Examiner intended to reject claim 28 under 35 U.S.C. § 103(a), not 35 U.S.C. § 102(e), and the rejection is being addressed accordingly.

The 35 U.S.C. § 103(a) Rejection of Claims 1, 3-15 and 27

As admitted by the Examiner, Mattson et al. fails to teach recessed portions. For this feature, the Examiner cites Chappo et al., and refers to items 52 and 54 in Figures 2 and 4, item 120 in Figure 10, and column 11, lines 4-8 of Chappo et al. as allegedly teaching the recessed portions.

Applicants respectfully submit, however, that Chappo et al. fails to teach or suggest the recessed portions as defined in the claims of the present application. Specifically, the Examiner contends on page 3 of the final Office Action that column 11, lines 4-8 of Chappo et al. teaches that notches or recesses are formed in the back-illuminated photodiode (BIP) array 52. However, Applicants respectfully note that this passage of Chappo et al. states that “[a]lternately, or additionally, the metal layers can be placed in notches or recesses formed in a peripheral edge 120 so as to prevent electrical contact between the metal layers 122 and adjacent readout ASICs when tiled together to form a mosaic.” (emphasis added). Applicants respectfully submit that this is completely unlike the claimed “recessed portions located opposite said light-incident surface.” (emphasis added).

Applicants further respectfully submit that as described, for example, in column 6, lines 15-16 of Chappo et al., item 54 references “bond pads 54” that are present on the back side of the back-illuminated photodiode (BIP) array 52. Applicants respectfully submit that it is not reasonable to interpret “bond pads” as “recesses.” Again, nowhere does Chappo et al. teach forming recesses in the BIP array 52. Rather, column 10, lines 32-35 of Chappo et al. state that the BIP array is “bump bonded via bumps 56 to a matching array of electronics on a readout application-specific integrated circuit (ASIC) 258,” and as discussed above, column 11, lines 4-8 of Chappo et al. describe notches or recesses formed in the peripheral edge, not in a surface that is opposite to the light-incident surface as explicitly recited in independent claim 1 of the present application. Accordingly, in no way does Chappo et al. teach forming recesses in the surface of the BIP array 52 opposite to that on which the scintillating layer 50 is formed, and thus cannot teach “a first conductive type semiconductor substrate having a light-incident surface and an opposite surface with a plurality of recessed portions located opposite said light-incident surface” as recited in independent claim 1 of the present application.

Concerning Bauer et al., Applicants respectfully submit that Bauer et al. discloses a photodiode array having projections formed at a side opposite the light incident surface. That is, in the Bauer et al. arrangement, a first zone (5.1) of second conductivity surrounds the projection. Applicants respectfully submit that the projections are not a frame part surrounding the recess as defined in the claims of the present application. Moreover, the first zone (5.1) is not formed at a bottom of a recess in the Bauer et al. arrangement.

Applicants further respectfully submit that Bauer et al. fails to teach that the semiconductor substrate is thinner in recessed portions of the first conductive type semiconductor substrate than in portions around the recessed portions as the Examiner contends. Rather, paragraph 0016 of Bauer et al. describes that “a single cell of the array comprises a central elevation which is formed by the second diode area 6.” Hence, as shown in Figures 1 and 2 of Bauer et al., these central elevations extend upward as peaks and, as further described in paragraph 0016 of Bauer et al., “[t]he first diode area 5 is arranged concentrically around the second diode area.” In other words, even assuming that the semiconductor substrate at the second diode area 6 is thicker than at the first diode area 5, this arrangement is opposite to that of the claimed embodiments in which “each of said recessed portions of said first conductive type semiconductor substrate is surrounded by portions of said first conductive type semiconductor substrate that form a frame part, located between a plurality of said recessed portions, which is thicker than and frames the respective recessed portion.” (emphasis added). Rather, in the Bauer et al. arrangement, the allegedly thicker second diode area 6 is surrounded by the thinner first diode area 5.

Accordingly, for at least the above reasons, this rejection should be withdrawn.

The 35 U.S.C. § 103(a) Rejection of Dependent Claim 16

In this rejection, the Examiner admits that Mattson et al., Chappo et al. and Bauer et al. fail to teach the crystal plane orientation recited in this claim. Nevertheless, the Examiner contends that Yamanaka et al. teaches this feature. However, Applicants respectfully submit that Yamanaka et al. fails to make up for the deficiencies in the teachings of Mattson et al., Chappo et al. and Bauer et al. as discussed above to have

rendered even independent claim 1 unpatentable. Accordingly, this rejection should be withdrawn.

The 35 U.S.C. § 102(a) Rejection of Claim 26

In this rejection, the Examiner contends that Chappo et al. teaches each and every feature recited in this claim. However, Applicants respectfully submit that as demonstrated above, Chappo et al. merely teaches forming notches or recesses in a peripheral edge. Applicants submit that Chappo et al. fails to teach “a back-illuminated photodiode array comprising a semiconductor substrate, wherein only one side of said semiconductor substrate has a plurality of recesses, and wherein each shape of openings of said recesses is square” as explicitly recited in claim 26. Accordingly, this rejection should be withdrawn.

The 35 U.S.C. § 102(e) Rejection of Claim 28

As discussed above, this rejection is based on Chappo et al. in view of Bauer et al., and should be a rejection under 35 U.S.C. § 103(a). Claim 28 depends from claim 26. Applicants submit that as demonstrated above, Chappo et al. thus fails to teach “a back-illuminated photodiode array comprising a semiconductor substrate, wherein only one side of said semiconductor substrate has a plurality of recesses, and wherein each shape of openings of said recesses is square” as explicitly recited in claim 26. Applicants further respectfully submit that as discussed above with regard to the rejection of claims 1, 3-15 and 27, Bauer et al. fails to make up for the deficiencies in the teachings of Chappo et al. to have rendered even independent claim 26 unpatentable. Accordingly, this rejection should be withdrawn.

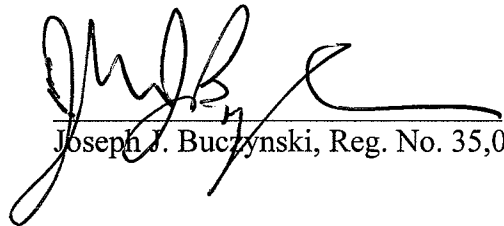
Withdrawn Claims 17-25

Applicants acknowledge the Examiner statement on page 2 of the final Office Action regarding withdrawn claims 17-25. However, Applicants respectfully submit that claim 17 depends from claim 7, which depends from claim 1, claim 20 depends from claim 4, which depends from claim 1, and claim 25 depends from claim 15, which depends from claim 1. Also, claims 18 and 19 depend from claim 17, and claims 21-24

depend either directly or indirectly from claim 20. Accordingly, Applicants submit that should claim 1 be found to be allowable, claims 17-25 should be allowable by their dependency. Hence, Applicants respectfully request that these claims be maintained in the present application

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. § 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0573. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,



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